TOF Performance

$$t_v = t_d - t_f$$

use detector information to predict time at vertex and match to known event start time -- get 0 if the correct particle hypothesis is used to to calculate t_f

$$\sigma(t_d) = \frac{1}{\sqrt{2}}\ 100\ \text{ps}$$

this is the TOF detector resolution, includes TDC

$$t_f = \frac{L}{\beta c} = \frac{L}{c}\sqrt{1 + \frac{m^2}{p^2}}$$

one must measure the flight path L and momentum p to predict t_f
(assume errors on L and p are uncorrelated)

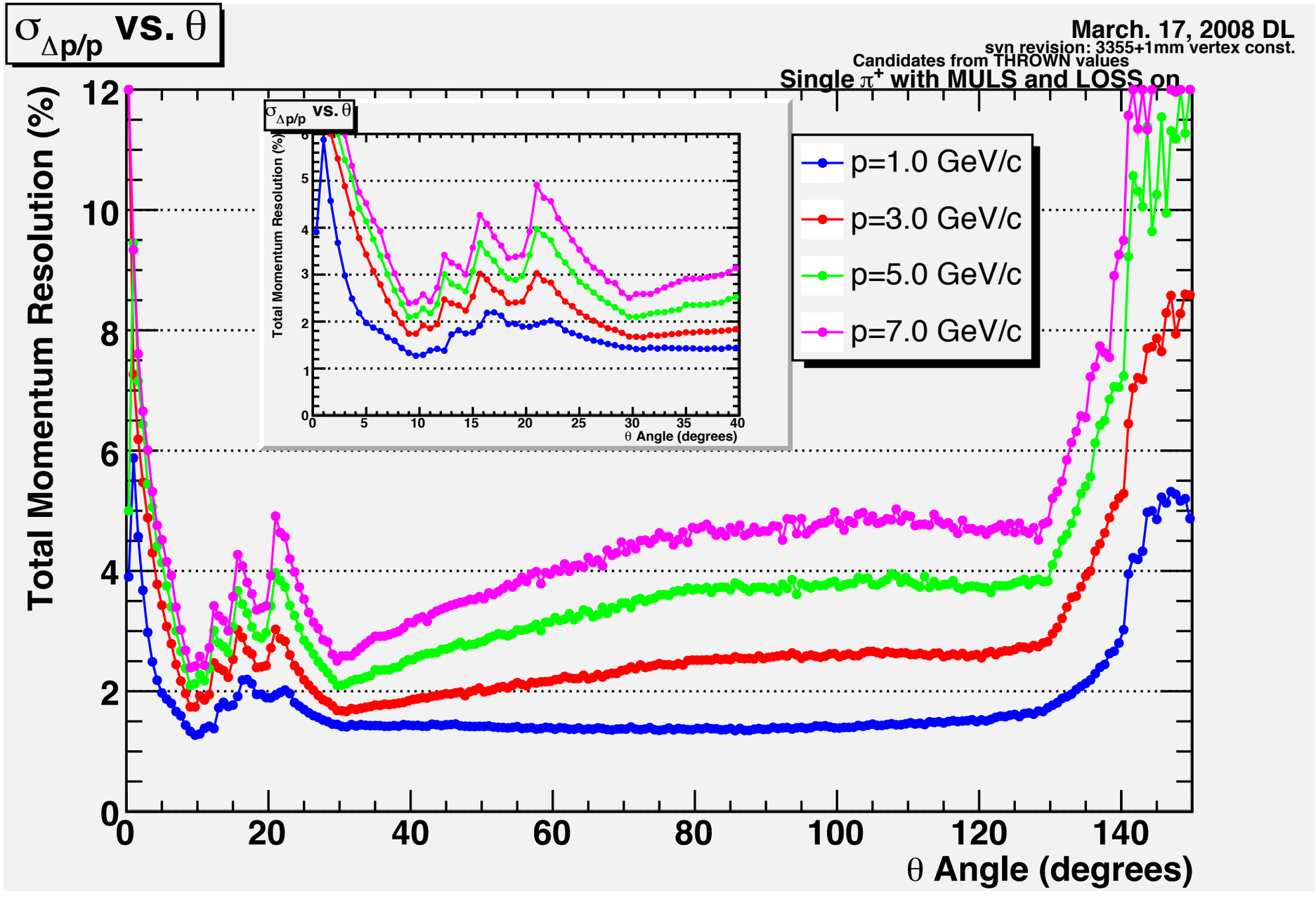
$$\frac{\sigma(t_f)_p}{t_f} = \frac{m^2}{p^2 - m^2}\frac{\delta p}{p}$$

contribution to the flight time error from the momentum resolution, which has been carefully studied

$$\frac{\sigma(t_f)_L}{t_f} = \frac{\delta L}{L}$$

contribution to the flight time error from the path length resolution

Tracking Resolution



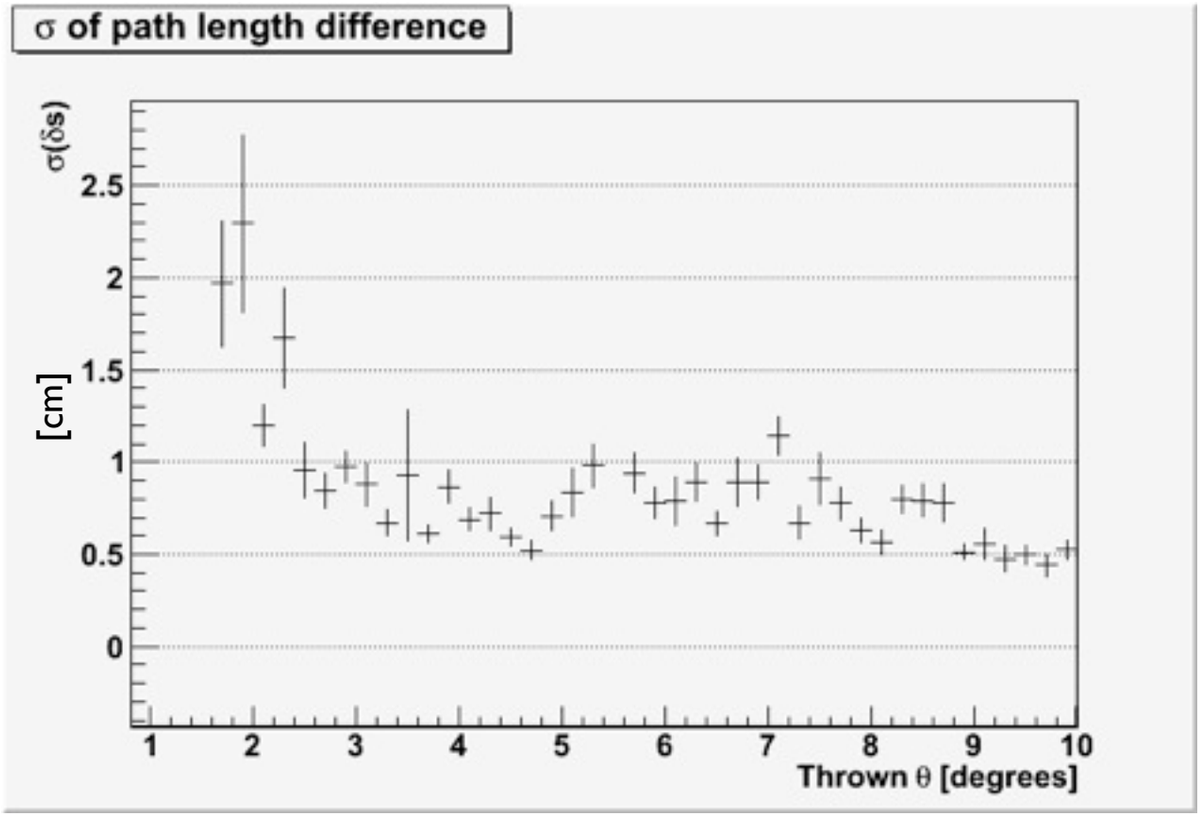
3% momentum resolution seems reasonable in forward direction

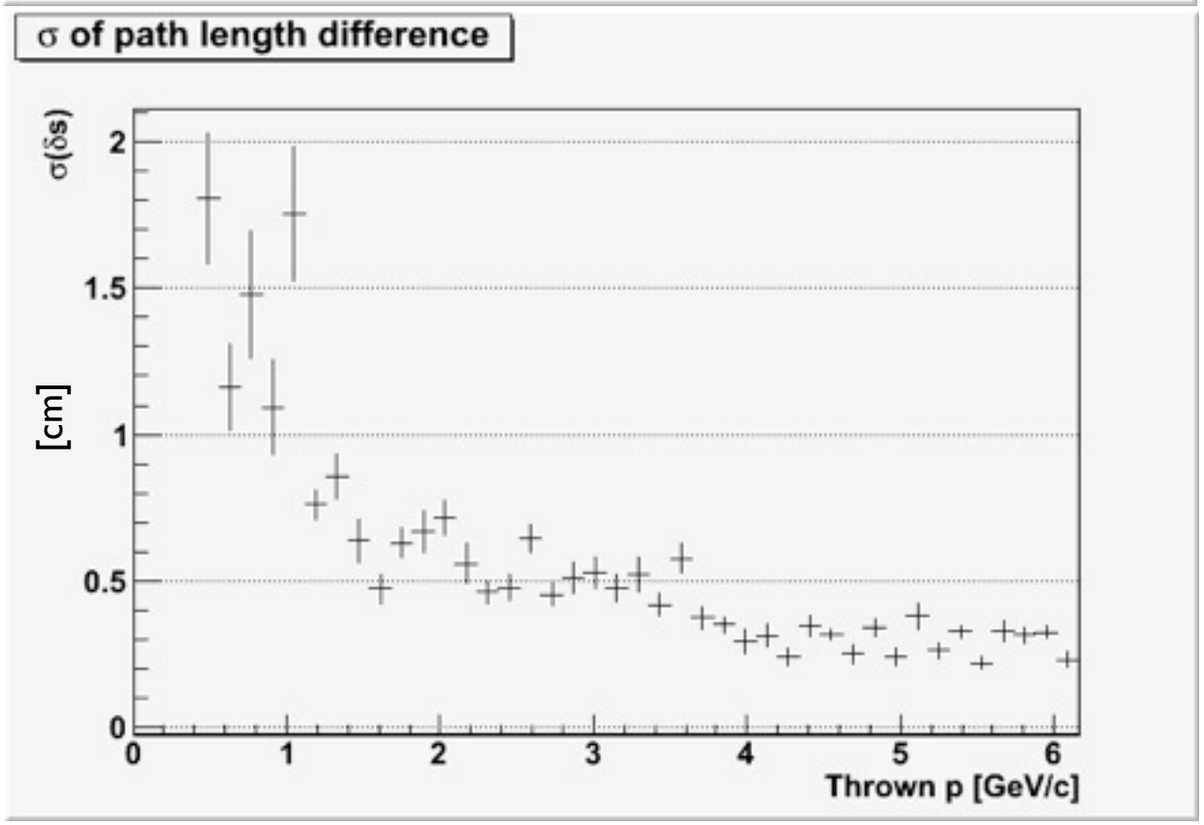
What is the path length error? (How well is field known and does it matter?)

PID Review Report assumes a path length error of 1 cm

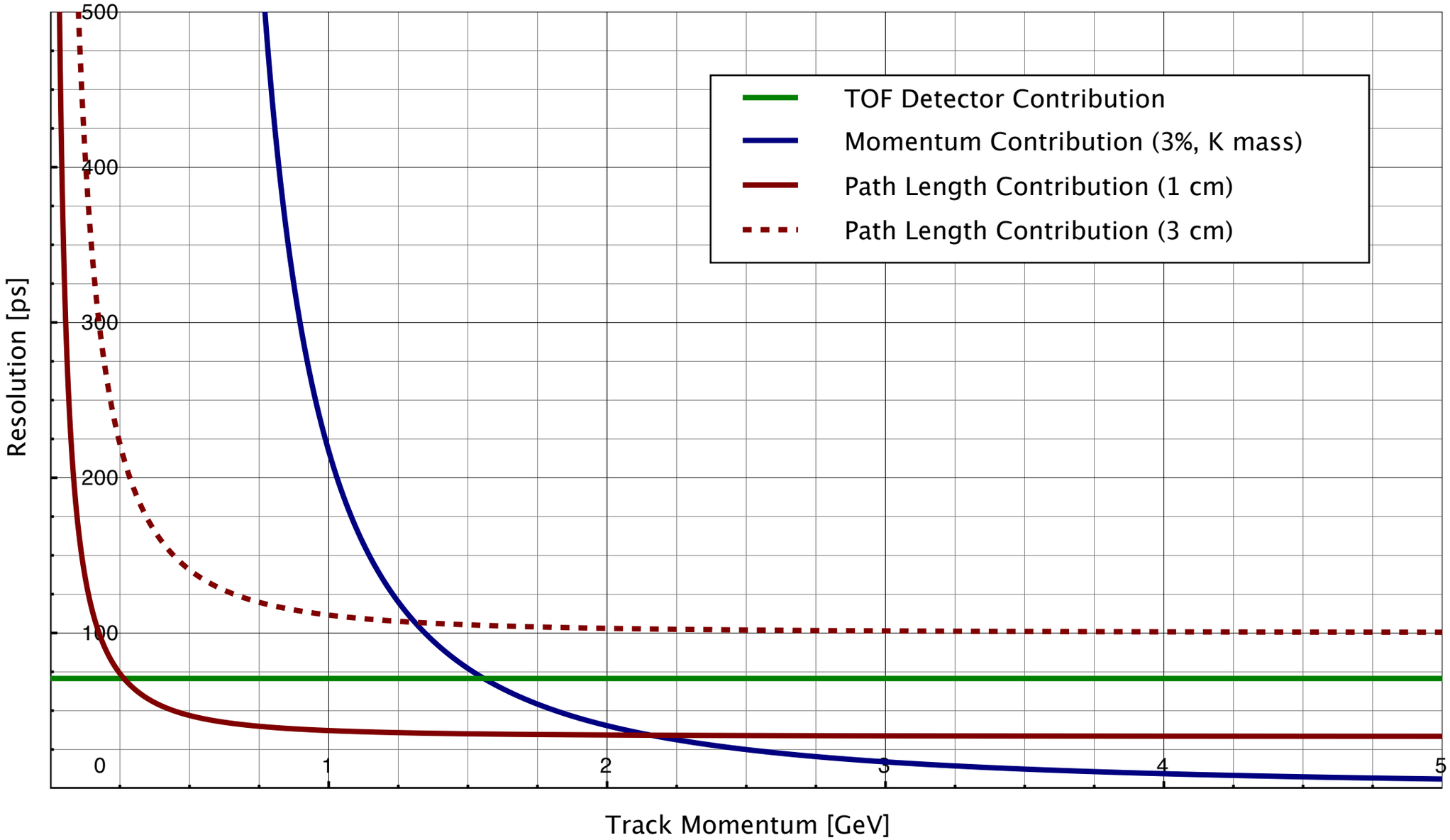
Preliminary Study

- Compare measured path length from tracking with thrown path length
- Plots of std-dev of the difference from Simon using:
  - Pion tracks
  - Assume location of TOF is known to infinite precision -- realistic contribution 1-5 mm
- 1 cm total seems reasonable?
- *Study does not probe dependence on systematic errors in magnetic field*

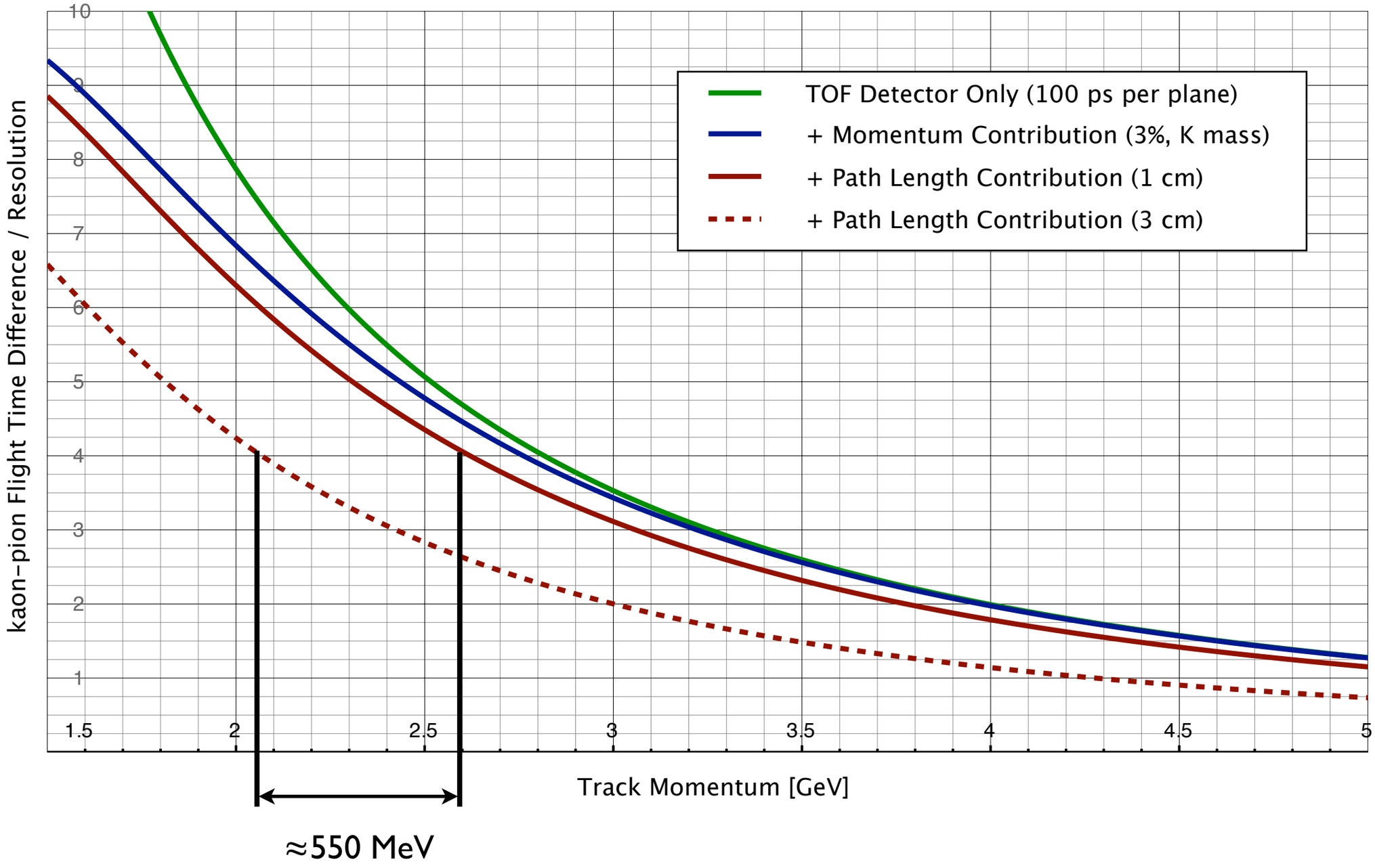




Resolution Contributors



K/π Separation



≈550 MeV

At 4σ K/π separation the difference between 1 cm and 3 cm path length error is substantial!

Assume TOF provides 4σ to 2 GeV to be conservative?

Kaon Kinematics